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3 April 1970

Materiel Test Procedure 2-3-514 U. S. Army Armor and Engineer

U. S. ARMY TEST AND EVALUATION COMMAND COMMON SERVICE TEST PROCEDURE

KIT INSTALLATION AND EVALUATION

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**OBJECTIVE** 

The objective of this Materiel Test Procedure (MTP) is to outline techniques for installing and testing of accessory kits for automotive type vehicles.

2. BACKGROUND

A kit, by definition, is an adjunct which, while extending the care bility of the equipment, usually should not detract from its normal functions. There are some exceptions to this definition, such as a tank-mounted flame thrower, which certainly affects the fighting characteristics of a tank. In addition, kits should be removable without detracting from the serviceability of the original equipment.

Kits, in the context of this MTP, are accessories which may be attached to vehicles to give them some capability beyond that of the original design. Vehicular kits could conceivably be used to facilitate the performance of any function or operation by or in a vehicle. The kits to be used on a specific vehicle are usually listed in the qualitative material requirement (QMR) or other appropriate document (reference 4A) for that vehicle. Space within vehicles, especially combat types, it always limited even in the original design. Therefore, fitting the various kits into the original design is often difficult. This problem is further compounded by changes in design of the parent vehicle during the preservice test stage. Such changes may range from just a few to many hundred.

۵ Some kits are installed by mechanics and become a permanent part of ☆ the vehicle; other are installed by the operator/crew for temporary use; some are partly installed by mechanics and completed by the operator/crew. The Linumber of kits required for each type vehicle will depend to a great extent -upon the intended roles of the vehicles and/or the geographic areas in which they will be used. For example, the following kits are required for the M151, 1/4-ton truck: Winterization (-60°F); Hardtop Enclosure; Door and Side Curtains; Hot Water Heater (-25°F); Deep Water Fording; 100 Ampere Generator (Alternator); Machinegun Mount; and M14 Rifle Mount.

Installation instructions are generally included in the appropriate technical manual or a modification work order. An installation test is needed to determine whether a kit can be installed at the indicated organization level within the time specified, when applicable, and the adequacy of installation instructions.

There are numerous reasons for evaluating each kit during the service test, the major ones are to determine whether it fulfills its intended purpose

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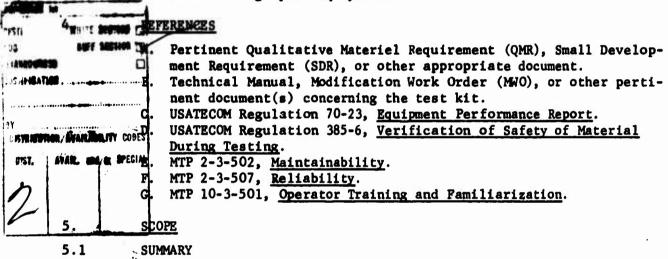
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or interferes with normal functions of the parent vehicle and/or other kits.

# 3. REQUIRED EQUIPMENT

- a. Appropriate Vehicle(s).
- b. Tools, Equipment, Facilities, and Material applicable to the organizational level required to install and maintain the test item.
  - c. Appropriate Test Area(s).
  - d. Still Photographic Equipment.



This procedure contains guidelines for the following:

- a. Preparation for Test An evaluation to determine the completeness of the test item, that it is in satisfactory condition prior to installation and testing, an indication of personnel training procedures and special equipment and facilities required.
- b. Kit Installation An evaluation of the installation characteristics of the test item and a determination of the adequacy of the instructions pertaining to these tasks.
- c. Compatibility A determination of the test kit's ability to function with the parent vehicle and installed kits.
- d. Functional Suitability A determination of the test kit to function under the various weather and other environments it will encounter.
- e. Maintainability An evaluation to determine and appraise the test kit's maintenance characteristics and requirements.
- f. Reliability An evaluation of the test item's operating time between failures and the mean time required for repair.
- g. Kit Removal An evaluation of the removal characteristics of the test item and a determination of the adequacy of the removal instructions.

#### 5.2 LIMITATIONS

This procedure is limited to kits for automotive type equipment other than vehicle modification kits designed to correct a deficiency existing in a given model.

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### 6. PROCEDURES

#### 6.1 PREPARATION FOR TEST

#### 6.1.1 Safety

The project officer shall ensure that a Safety Release has been received from Headquarters, USATECOM, in accordance with reference 4D and is understood, and he shall record the date of receipt and restrictions on the use of the material, if any.

# 6.1.2 Personnel Training

Ensure the availability of qualified personnel for parent vehicle operator/crew and maintenance who have been trained using the procedures of MTP 10-3-501, and the following:

### 6.1.2.1 Using Instructional Material and Training Aids

NOTE: Although training cannot be completed without the kit and 'parent vehicle, enough can be accomplished with instructional material and training aids to justify the time and effort expended. Furthermore, the time allowed for testing after the material is received is usually the minimum estimated for actual testing, with little or no allowance for training or even time lost due to mechanical failures.

- a. If installation instructions, drawings, etc., are available, they should be given to the appropriate personnel for study and familiarization with the kit design and their respective roles in installing the kit on the parent vehicle.
- b. If the kit is completed and adequate instructional material and training aids are available, classes should be conducted for participating personnel by instructors who either had practical experience in installing the kit, or attended a school where instruction is given on making such installations.

NOTE: If such instructors are not available, consideration should be given to using manufacturer's representatives for this task.

- c. Training of mechanics shall be based upon the complexity of the tasks to be performed, tolerances allowed, and safety hazards.
- d. Due consideration shall be given to potential safety hazards to personnel or damage to the parent vehicle because of faulty installation as well as damage to kit components.
  - e. Record the following:
    - 1) Amount of training conducted prior to the arrival of test material.
    - 2) Written material available and training aids used.

- 3) For each participant:
  - a) Name, rank or grade
  - b) Military occupational specialty (MOS)
  - c) Experience in MOS
  - d) Special training for the equipment, if any

# 6.1.2.2 Using Test Item

NOTE: Extent of training required on the test item itself will depend upon the amount accomplished before it arrived, the complexity of the kit, and the potential safety hazards involved in the installation or its subsequent use.

Operator/crew personnel and maintenance personnel shall examine the test item and parent vehicle and become familiar with the following:

- a. For operator/crew personnel:
  - 1) Nomenclature of each component and where and how it will be installed.
  - 2) Precautions to be observed during installation and post installation checks, if any.
  - 3) Amount of, and technique to be used when applying sealing compound or similar material, when required.
- b. For maintenance personnel:
  - Instructional material, including all drawings and blueprints.
  - Type and amount of support equipment which would be required (i.e., wreckers, welders, etc.) if not already listed in the instructional material.
- c. Record the following, as applicable:
  - 1) Type and amount of training conducted
  - 2) Training literature and aids used
  - 3) Adequacy of training literature and aids
  - 4) For each participant:
    - a) Name, rank or grade
    - b) MOS

#### 6.1.3 Parent Vehicle and Facilities

Arrangements shall be made for:

a. The use of a parent vehicle which is clean, in a serviceable condition and based upon the kit requirements to be tested, e.g., durability and reliability, compatibility with operations of crew and mechanics, compat-

ibility with other vehicle kits and vehicle operations.

b. Sufficient shop space, with special tools and/or equipment as required, so that all components can be displayed, inventoried, inspected, and installed on the vehicle.

NOTE: Although requirements may indicate that a particular kit should be installed under normal field conditions, the initial inspection and installation should be done in a clean, sheltered area so as to reduce unknown variables to a minimum.

# 6.1.4 Inspection

#### 6.1.4.1 Arrival Inspection

Upon receipt of the test materiel, perform the following:

- a. Record the date of receipt, mode of shipment, and method of unloading.
- b. Visually examine the test item packing crate and record the following:
  - 1) Damage to packing crates, boxes. etc.
  - 2) Undone bindings

# 6.1.4.2 Preinstallation Inspection

Using the shop space of paragraph 6.1.3.b, carefully unpack all components, remove them from their containers and perform the following:

- a. Visually inspect the components for, and record evidence of damage or deterioration, and, if known, probable cause of damage, and photograph all such conditions.
- b. Record the stock number, part number of manufacturer's number of each component and check the items against the shipping document, technical manual, modification work order, or other appropriate document, if applicable, record all shortages and prepare an Equipment Performance Report in accordance with reference 4C, when applicable.
  - c. Record all instruction material received.
- d. Arrange components by group on the floor or other appropriate space, with proper identification for each component, and photograph them and record difficulties, if any, in identifying each component.
- e. Clean and/or service all components in accordance with published instructions for the kit or, if none are available, establish maintenance procedures.

### 6.2 TEST CONDUCT

NOTE: It is highly desirable to install on one vehicle all kits that

are to be used concurrently, preferably during service test of the vehicle.

### 6.2.1 Kit Installation

NOTE: There are so many vehicular kits used in the Army and their complexity varies to such an extent that it would be difficult, if not impossible, to cover all possible contingencies in a single procedure. Therefore, guidance in this MTP will emphasize procedures and precautions for the more complex items such as the underwater fording lits, where even minor errors or omissions could create a potential safety hazard to personnel or damage the vehicle. For installation of less complex items such as a machinegun mount kit or a door and side curtain kits, the project officer should use his judgment in selecting the portions that are applicable to the test item concerned.

#### 6.2.1.1 Operator/Crew

- NOTE: 1. The allowable time for operator/crew to install some kits is established in the QMR,SDR, or other appropriate document (reference 4A). This time period is established on the supposition that adequate instructions for making the installation are available, that all components of the kit will fit and perform the intended function, and that the operator/crew have been properly trained in installation procedures.
  - Although there is no reason why each installation should not be timed, time should not be used for comparison with the established test criterion until the instructions are determined to be satisfactory and personnel have been properly trained.
  - 3. The underwater fording kit for M60 series tanks is an example of a kit with a specified maximum allowable time for installation. To meet the allowable time on this kit, it was necessary to assign specific tasks to each crew member similar to crew drill procedures. In some cases one crew member performed the complete task, while in others two or more crewmen collaborated on a task. Even on kits such as this, the initial installation should be made on a one task at a time basis. In addition to permitting thorough supervision, this procedure will acquaint each crewman with the duties to be performed by other members. Upon completion of each of these tasks, the project officer should point out to the crew the task(s) that others would have been doing concurrently.
- a. Perform the initial installation of the test item kit on the parent vehicle at a moderate (untimed) pace, suitable for a practical instruction period for the crew and to verify the following:

- 1) Adequacy of instruction for kit installation.
- 2) Adequacy of operator/crew training in installation procedures.
- 3) Effectiveness in the distribution of tasks assigned to operator/crew as an installation team.
- 4) Adequacy of prescribed post installation checks and test.
- b. Repeat step a until the timed installation of the kit is achieved within specified time or the project officer considers that the crew has reached the maximum proficiency that can be expected.
  - NOTE: 1. On the simpler kits with no specified time limit, one installation will probably suffice for instructional purposes.
    - 2. For kits requiring more than one installation, do not repeat the operation one after the other, but schedule them over the entire service test period.
- c. At the completion of each installation perform all required checks and/or tests.
  - d. Record the following:
    - 1) Time allowed for installation of kit, when specified.
    - 2) Time (man-hours and clock-hours) for each of the personnel (by MOS) required to make the initial installation.
    - 3) Tools required to install item.
    - 4) Changes needed, if any, in published installation instructions.
    - 5) Changes needed, if any, in prescribed sequence of installation.
    - 6) Difficulties, if any, in installing test kit.
    - 7) Number of times test kit was installed.
    - 8) Minimum and mean time required to install test kit, when applicable.
    - 9) Results of post installation check(s).
    - 10) Adequacy of post installation check(s).

### 6.2.1.2 Maintenance Personnel

NOTE: Unlike the operator/crew, the installation tasks assigned to maintenance personnel should be similar to tasks they perform on a day to day basis. If they are not similar then the operation is assigned to the wrong maintenance level.

- a. Commence installation at the level of maintenance specified. Install each component in the order indicated by and in accordance with published instructions, drawings, etc.
- b. Upon completion of installation, perform all required checks and/or tests and record the following:
  - Level of maintenance specified in QMR, SDR, etc., for installation.
  - 2) Level of maintenance that actually made the installation, with

reasons for changing if different than specifed.

- 3) Time (man-hours and clock-hours) required to make the installation, with breakdown of personnel required showing MOS and total time for each individual.
- 4) Tools and equipment required.
- 5) Changes, if any, needed for published installation instructions, drawings, diagrams, etc.
- 6) Changes, if any, made in the prescribed sequence of installation with reasons therefor.
- 7) Modifications required to the parent vehicle, if any.
- 8) Modifications required to the test kit, if any.
- 9) Results of post installation check,
- 10) Adequacy of post installation check.

# 6.2.2 Compatibility

With the test kit installed perform the following:

a. Operate the parent vehicle and the test kit through a complete cycle of the functions for which each was designed.

NOTE: If the parent vehicle is undergoing service testing these functions will be covered in the plan for that test, and the test item can be utilized during appropriate test phases.

- b. Throughout testing have the operator /crew observe for operational and physical incompatibilities between the test kit and the parent vehicle, and between the test kit and other kits installed on the vehicle and record the following:
  - 1) List of kits designed to be used concurrently with the test kit on the parent vehicle.
  - 2) List of all other kits installed on the parent vehicle in addition to the test kit.
  - 3) Any incompatibilities between the test kit and the parent vehicle, or any other kit.

### 6.2.3 <u>Functional Suitability</u>

- a. Operate and utilize the installed test kit through all the functions for which it was designed in as many different weather and other environmental conditions as possible and/or prescribed in the QMR, SDR, etc., to include jettison of components, when applicable.
- b. Have test personnel check for and record any failure to fulfill the functional requirements delineated in these cited documents.

#### 6.2.4 Maintainability

a. Perform operator/crew and scheduled preventive maintenance services prescribed for the test kit along with those services for the parent vehicle and

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other kits which could be adversely affected by the test kit.

b. Perform to the extent practicable during the evaluation all authorized organizational maintenance operations listed in the maintenance allocation chart for the test kit.

NOTE: Organizational maintenance tasks, such as replacement of parts, not required during the evaluation period should be performed upon completion of testing.

- c. A sampling of direct and general support maintenance should be accomplished to the extent feasible with the resources at hand. In addition, prescribed organizational maintenance should be performed on those parts of the parent vehicle and other kits which might be affected by the test kit.
- d. Determine active maintenance time, maintenance ratio and other maintainability characteristics as described in applicable sections of MTP 2-3-502.
  - e. Record the following:
    - 1) Each operator/crew preventive maintenance service performed on the test kit, the time (test miles, hours, etc.) it was performed and difficulties encountered because of design, equipment publications, blueprints, tools, etc., if any.
    - Man-hours and clock-hours required to perform the above services.
    - 3) Operator/crew preventive maintenance services on the parent vehicle and other kits, when applicable, which were adversely affected by the test kit.
    - 4) Operator/crew time (man-hours and clock-hours) spent in replacing parts and assisting mechanics.
    - 5) Each task performed on the test kit by maintenance personnel showing level of maintenance (organizational, direct or general support), whether task was scheduled or unscheduled, man-hours and clock-hours required, miles/hours on test kit, and difficulty encountered because of design, equipment, publications, blueprints, tools, etc., if any.
    - 6) Potential safety hazards in performing maintenance tasks, if any.

#### 6.2.5 Reliability

Determine the reliability characteristics of the test kit as described in applicable sections of MTP 2-3-507 and the following:

a. Operate and utilize each kit for the number of miles, hours, number of operations, etc., as specified in the QMR, SDR, Test Directive or other appropriate document.

NOTE: The expected useful life of kits will vary. For example, a machinegun mount kit would be expected to last throughout the entire life of the vehicle, whereas traction devices for

tank tracks might not be expected to last more than 200 miles.

# b. Record the following:

- Total time test kit was operated (miles, hours, number of operations, etc.).
- 2) Each failure.
- Active maintenance time to repair failures by maintenance level.
- 4) List of repair parts received with the test kit.
- 5) List of repair parts used.
- 6) Difficulty, if any, in interchangeability of part replaced.

# 6.2.6 Kit Removal

NOTE: Careful removal of kits such as those for underwater fording is extremely important because the kit itself, including many of the seals, is expected to be re-used several times. The word "removal" as used in this context is not intended to cover jettison of material to immediately enhance the land combat capability of the parent vehicle. This procedure is intended primarily as an adjunct to reinstallation, since the installation must be repeated on some kits to obtain the desired degree of efficiency.

- a. Remove kit components carefully in accordance with published instructions. Record changes needed in the instructions including changes in the prescribed installation sequence.
- b. Examine all components that are to be used again, especially seals or gaskets, record and photograph any indication of deterioration, wear or damage. Make every effort to determine the cause of damage and correct it, if possible, so that the quantity of seals, gaskets, etc., required in the kit are kept to a minimum.
- c. For those kits were repeated removal is required as a part of normal use, record the following:
  - 1) Time (total man-hours and clock-hours) required for removal and the number of personnel (by MOS) needed for removal.
  - 2) Difficulties, if any, encountered during removal.
  - 3) Results of post removal inspection to include damage, deterioration, wear, etc., to each component with probable cause, if determinable, and an indication as to whether the component(s) were still serviceable.
  - 4) Total number of times the kit was removed.
  - 5) Total number of each type component replaced throughout the testing period.

#### 6.3 TEST DATA

# 6.3.1 Preparation for Test

# 6.3.1.1 Safety

Record the following:

- a. Date safety release was received
- b. Restrictions on the use of the materiel, if any

# 6.3.1.2 Personnel Training

Record the following; as applicable:

- a. Data collected as described in the applicable sections of MTP 10-
- 3-501.
- b. Amount of training conducted, in hours:
  - 1) Prior to arrival of test materiel
  - 2) After arrival of test materiel
- c. Written material available and training aids used:
  - 1) Prior to arrival of test materiel
  - 2) After arrival of test materiel
- d. Adequacy of training aids and written material
- e. For test personnel:
  - 1) Name, rank or grade
  - 2) MOS
  - 3) Experience in MOS
  - 4) Special training received

#### 6.3.1.3 Inspection

#### 6.3.1.3.1 Arrival Inspection -

Record the following:

- a. Date test materiel received
- b. Mode of shipment
- c. Method of unloading
- d. External damage to crates, boxes, etc., if any

# 6.3.1.3.2 Preinstallation Inspection -

- a. Record the following, as applicable:
  - 1) Evidence of damage or deterioration.
  - 2) Probable cause of damage if known.
  - Components received by stock and part number or manufacturer's number.

- 4) Missing components.
- 5) Instructional material received.
- 6) Difficulties identifying components.
- b. Retain all photographs

# 6.3.2 Test Conduct

#### 6.3.2.1 Kit Installation

### 6.3.2.1.1 Operator/Crew -

Record the following, as applicable:

- a. Time allowed for installation of kit, when specified.
- b. Time (man-hours and clock-hours) for each of the personnel (by MOS) required to make the initial installation.
  - c. Tools required to install item.
  - d. Changes needed, if any, in published installation instructions.
  - e. Changes needed, if any, in prescribed sequence of installation.
  - f. Difficulties, if any, in installing test kit.
  - g. Number of times test kit was installed.
  - h. Minimum and mean time required to install test kit, when applicable.
  - i. Results of post installation check(s).
  - j. Adequacy of post installation check(s).

#### 6.3.2.1.2 Maintenance Personnel -

# Record the following:

- a. Level of maintenance specified in QMR, SDR, etc., for installation.
- b. Level of maintenance that actually made the installation, with reasons for changing if different than specified.
- c. Time (man-hours and clock-hours) required to make the installation, with breakdown of personnel required showing MOS and total time for each individual.
  - d. Tools and equipment required.
- e. Changes, if any, needed for published installation instructions, drawings, diagrams, etc.
- f. Changes, if any, made in the prescribed sequence of installation with reasons therefor.
  - g. Modifications required to the parent vehicle, if any.
  - h. Modifications required to the test kit, if any.
  - i. Results of post installation check.
  - j. Adequacy of post installation check.

#### 6.3.2.2 Compatibility

Record the following:

- a. List of kits designed to be used concurrently with the test kit on the parent vehicle.
- b. List of all other kits installed on the parent vehicle in addition to the test kit.
- c. Any incompatibilities between the test kit and the parent vehicle, or any other kit.

#### 6.3.2.3 Functional Suitability -

# Record the following:

- a. Description of unfulfilled functional requirement.
- b. Operational situation involved.
- c. Resultant damage, if any to kit and parent vehicle.
- d. Comments of test personnel pertinent to the functional failure or inadequacy.

# 6.3.2.4 Maintainability -

#### Record the following:

- a. Data collected as described in applicable sections of MTP 2-3-502.
- b. Each operator/crew preventive maintenance service performed on the test kit, the time (test miles, hours, etc.) it was performed and difficulties encountered because of design, equipment publications, blueprints, tools, etc., if any.
  - c. Man-hours and clock-hours required to perform the above services.
- d. Operator/crew preventive maintenance services on the parent vehicle and other kits, when applicable, which were adversely affected by the test kit.
- e. Operator/crew time (man-hours and clock-hours) spent in replacing parts and assisting mechanics.
- f. Each task performed on the test kit by maintenance personnel showing level of maintenance (organizational, direct or general support), whether task was scheduled or unscheduled, man-hours and clock-hours required, miles/hours on test kit, and difficulty encountered because of design, equipment publications, blueprints, tools, etc., if any.
  - g. Potential safety hazards in performing maintenance tasks, if any.

# 6.3.2.5 Reliability -

#### Record the following:

- a. Data collected as described in applicable sections of MTP 2-3-507.
- b. Total time test kit was operated or utilized (miles, hours, number of operations, etc.).
  - c. Each failure.
  - d. Active maintenance time to repair failures by maintenance level.
  - e. List of repair parts received with the test kit.
  - f. List of repair parts used.

g. Difficulty, if any, in interchangeability of parts replaced.

#### 6.3.2.6 Kit Removal

- a. For those kits where repeated removal is required as a part of normal use, record the following:
  - Time (total man-hours and clock-hours) required for removal and the number of personnel (by MOS) needed for removal.
  - 2) Changes, if any, needed in published removal instructions.
  - 3) Changes, if any, made in prescribed removal sequence, with reasons therefor.
  - 4) Difficulties, if any, encountered during removal.
  - 5) Results of post removal inspection to include damage, deterioration, wear, etc., to each component with probable cause, if determinable, and an indication as to whether the component(s) were still serviceable.
  - 6) Total number of times the kit was removed.
  - 7) Total number of each type of component replaced throughout the testing period.
  - b. Retain photographs.

#### 6.4 DATA REDUCTION AND PRESENTATION

All data obtained by inspection, observations, photographs, testing and maintenance should be suitably tabulated or otherwise arranged and presented in a manner to indicate whether the test item meets the applicable criteria.

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